All this, however, does in no way interfere with our actual practise of grading. Our division lines between the different grades may be drawn somewhat arbitrarily, the relative credit given for the different grades may be somewhat arbitrary, the injustice done the students under a system which enforces uniformity of grading is nevertheless small compared with the injustice when each instructor is left to grade according to his own fancy.

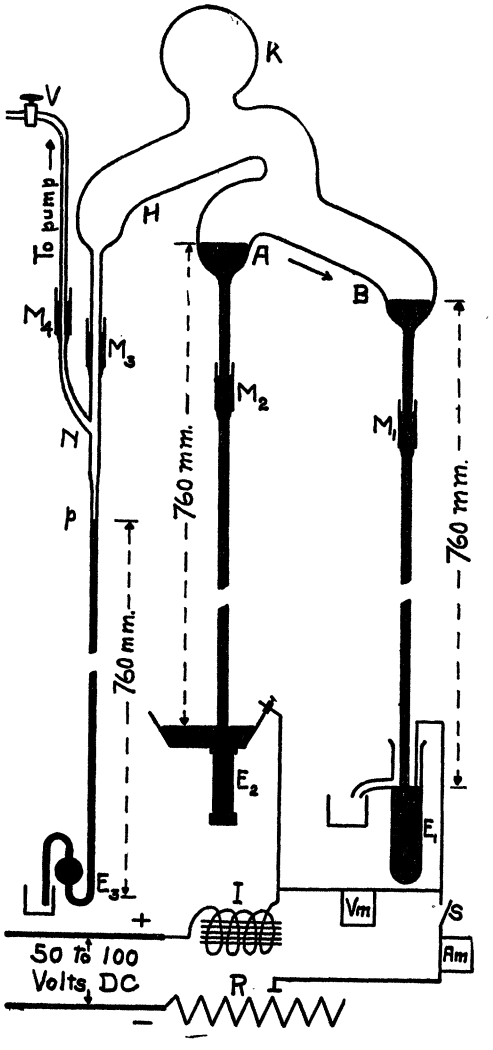
MAX MEYER
UNIVERSITY OF MISSOURI

AN EFFICIENT AND RAPID MERCURY STILL

IT is with some hesitancy that the writer attempts a description of so simple and commonplace an apparatus as a mercury still. Nearly every laboratory has its own method of purifying mercury. However, of the various "dry" methods that are usually employed two stand out prominently—Weinhold's method and Hulett's method.[1] The principle of the first is to distil under reduced pressure or partial vacuum; while the second in addition to this makes use of a small jet of air bubbling up through the mass of mercury. The jet of air plays the rôle of oxidizing the metallic impurities. Both methods are good. The purifying effect of air bubbling through mercury, even at room temperature, is now well recognized.

In 1905 the writer described a new form of still,[2] in a brief paper read before the American Association for the Advancement of Science, at its New Orleans meeting, in which use was made of the mercury vapor lamp. A description of the apparatus[3] as at present modified and perfected by several years' use in the laboratory is the object of this paper.

It is common observation that mercury condenses on the walls at the cooler parts of the lamp. Now by fusing to the mercury vapor lamp a properly shaped condensing chamber, mercury of a high degree of purity may be obtained. For the apparatus to be a practical working still the lamp must have additional modifications. Fig. 1 shows all of the essential parts. The mercury arc is maintained between the electrodes A and B. These electrodes are of mercury and are in communication, through the narrow barometric legs BE_1 and AE_2, with the vessels E_1 and E_2 containing the supply mercury. These vessels are connected directly through an adjustable resistance and an inductance to some convenient source of direct current. It is well to include



[1] Hulett, *Phys. Rev.*, Vol. XXI., December, 1905.
[2] SCIENCE, Vol. XXIII., March 16, 1906.
[3] Letters Patent, U. S. A., Nos. 891,264, 891,265; Germany, No. 201,017.

in the circuit an ammeter, a voltmeter and a switch as shown in the figure.

The condensing chamber HK may have a variety of forms—the one sketched possibly serves the purpose best. It will be noticed that the condensed mercury is, by the inclination of the tube H, diverted and leaves the still through a capillary delivery tube M_3E_3 bent into the form of an S at its lower end. The action of the mercury dropping into this tube is that of a continuous mercury pump. The nipple N for initially exhausting the system is fused, for convenience, to the upper end of this delivery tube. M_1, M_2, M_3, M_4 are mercury seals.

The operation of the still is very simple and when once under way needs but little attention. Fill the vessels E_1 and E_2 with the mercury to be distilled and allow the mouth of the delivery tube to dip into a small beaker of clean mercury. Now start the exhaust pump (an efficient mechanical pump will answer) and adjust the position of the vessels E_1 and E_2 until the electrodes A and B rise to the heights indicated in the figure. The mercury in the delivery tube should now stand at some point p 5 or 6 cm. below the nipple N. To start the arc it is only necessary to lift the vessel E_2 slightly and allow a momentary stream of mercury to flow down the tube AB. If the vacuum is right the arc should start instantly. Adjust the current to the proper value. After fifteen or twenty minutes the valve V may be closed, provided the various mercury seals do not leak. The supply mercury is drawn mostly from the vessel E_2 and it therefore should be of large surface and rather shallow. The vessel E_1 is provided with an overflow.

The rate of distillation depends upon the size of the apparatus and the strength of current employed. In the stills as first constructed the diameter of the tube AB was about 20 mm. This gave for a current of 4 amperes approximately one pound per hour. The corresponding fall of potential across the terminals was 21 volts. Later the diameter of AB was increased to 40 mm. and its length to 25 cm. The size of the condensing chamber HK was proportionately larger. This still gave for a current of 10 amperes approximately 2 pounds per hour. The potential difference across the terminals was 23 volts.

To test the purity of the distillate zinc amalgams were used. The test for zinc was made by the electromotive-force method described by Hulett. One millimeter deflection of the galvanometer corresponded to approximately .0005 volt. The results are given in the following table:

No.	Zinc Amalgam	Distillate from Zinc Amalgam	Deflection of Galvanometer
2*a*	1:700,000	—	2.17 mm.
100	1:370,000	—	4.00 "
a		1:1740	.61 "
b		1:1740	—.19 "
c		1:1740	.55 "

From numbers 2*a* and 100 we see that a deflection of 1 mm. corresponded to the presence of zinc in the ratio of 1:1,500,000. Samples *a*, *b*, *c* were from an amalgam that was, comparatively speaking, very impure to zinc, yet the distillates condensed in three separate condensing chambers showed practically no trace of zinc. The standard against which the above was balanced in the test cell was newly purchased commercial double distilled mercury and was in addition carefully and repeatedly purified by the "wet" method. Numerous additional tests under various conditions have been made and all show that the still is capable of giving a distillate of the highest purity. In fact, very pure mercury may be obtained by a single distillation even though the original is very impure. As an example may be given a test in which the original mercury was excessively impure to zinc. After distilling off six or eight pounds the current was broken and the apparatus let stand over night. In the morning the anode was completely covered with a layer of zinc an eighth of an inch thick that had crystallized out on cooling. The distillate showed scarcely a trace of zinc. In this instance the arc was maintained by a small current density and consequently the average temperature[4] in the

[4] Knipp, *Phys. Rev.*, Vol. XXXI., August, 1910.

arc was very much below the melting point of zinc.

The residue remains within the still. This should be digested out from time to time, depending upon the condition of the impure mercury. Where one is dealing with comparatively pure mercury 50 to 75 pounds may be distilled off during a single run.

CHAS. T. KNIPP

LABORATORY OF PHYSICS,
UNIVERSITY OF ILLINOIS,
January, 1911

THE ASSOCIATION OF AMERICAN GEOGRAPHERS

THE seventh annual meeting was held at Pittsburgh, December 29–31, 1910, under the presidency of Dr. H. C. Cowles, of the University of Chicago. His address was upon the subject, "The Causes of Vegetative Cycles." Public lectures were given by Professor Mark Jefferson on "Rocky Mountain Forms," and by Dr. Cowles on the "Origin and Destiny of the Everglades." Professor Rollin D. Salisbury conducted a round table conference on the "Purposes of Geographic Instruction, and the Phases of the Subject best adapted to these Purposes." About twenty-five papers were read by the members.

The following officers were elected: *President* Professor Ralph S. Tarr, Cornell University; *First Vice-president,* Alfred H. Brooks, U. S. Geological Survey; *Second Vice-president,* Henry G. Bryant, president of the Geographical Society of Philadelphia; *Secretary,* A. P. Brigham, Colgate University; *Treasurer,* Professor N. M. Fenneman, University of Cincinnati; *Councillor* (for three years), Professor Herbert E. Gregory, Yale University.

The following were appointed as delegates to the Geographical Congress to be held in Rome in October, 1911: Cyrus C. Adams, A. P. Brigham, H. C. Cowles, W. M. Davis, H. W. Fairbanks and Ralph S. Tarr.

Members newly elected are: Charles A. Davis, U. S. Bureau of Mines; F. V. Emerson, University of Missouri; Otto E. Jennings, Carnegie Museum, Pittsburgh; Wolfgang L. G. Joerg, American Geographical Society; Alexander G. Ruthven, University of Michigan; Victor E. Shelford, University of Chicago; L. H. Wood, Western State Normal School, Michigan.

The association has voted to establish a publication, and has appointed the following publication committee: Richard E. Dodge, chairman and editor, Alfred H. Brooks, Henry C. Cowles and Ralph S. Tarr.

Following the discussions of the round-table conference, the association adopted the resolutions herewith appended.

"The Association of American Geographers at its Pittsburgh meeting, December 29–31, discussed the present status of physical geography in secondary education and passed the following resolutions:

"*Resolved,* that in the opinion of this association physical geography fully deserves to retain a place in the high school.

"That the disappointment or dissatisfaction sometimes expressed regarding the results of teaching this subject is in large measure due to inefficient teaching.

"That as a means of removing this dissatisfaction, superintendents and principals are urged to procure teachers of physical geography adequately prepared in their subject, and to entrust the subject only to such teachers.

"That no teacher of physical geography should be appointed in any educational grade who has not made serious and special study of the subject in a higher educational grade."

A committee on state educational bulletins was appointed to report at the next meeting: N. M. Fenneman, chairman, W. M. Davis and R. H. Whitbeck.

The next meeting will be held in Washington in connection with the American Association for the Advancement of Science.

ALBERT PERRY BRIGHAM,
Secretary

SOCIETIES AND ACADEMIES

THE FOURTH ANNUAL MEETING OF THE ILLINOIS STATE ACADEMY OF SCIENCE

THE fourth annual meeting of the Illinois State Academy of Science was held Friday and Saturday, February 17 and 18, at the University of Chicago.

About two hundred persons attended the combined sessions of the two days, and the excellence of the papers and the general air of enthusiasm which prevailed was on a par, if not in excess, of previous meetings. The total membership is now four hundred and eight; of this number, thirty-seven were elected at the Chicago meeting. A study of the geographic distribution of the membership is significant, as the annexed table shows.